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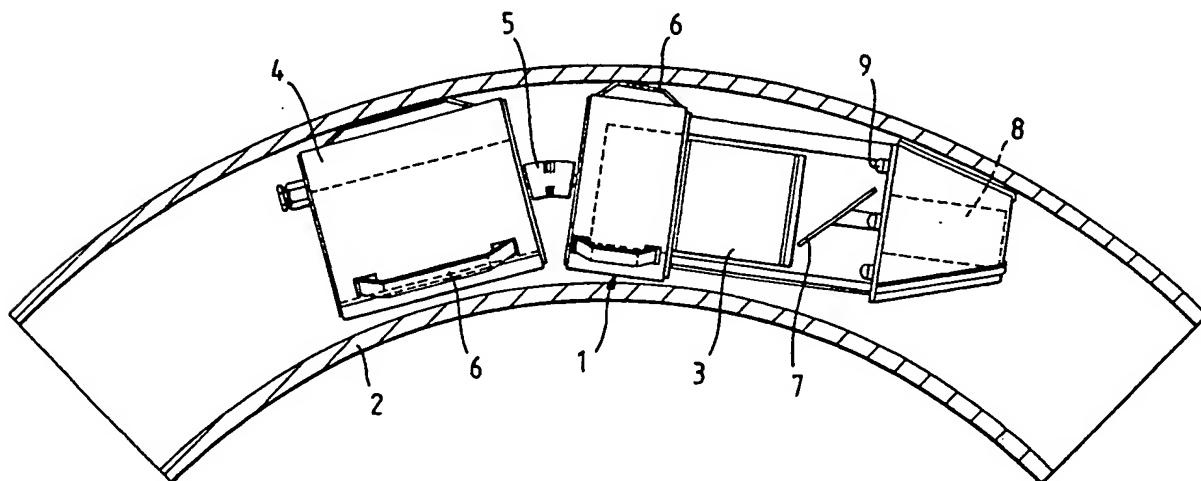
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## (54) Pipework inspection apparatus

(57) An apparatus for the internal inspection of pipework comprises a TV camera system in which the optical 3 and electronics 4 portions are physically separate units joined together by an articulated joint 5. This enables the camera system to negotiate bends in pipework.

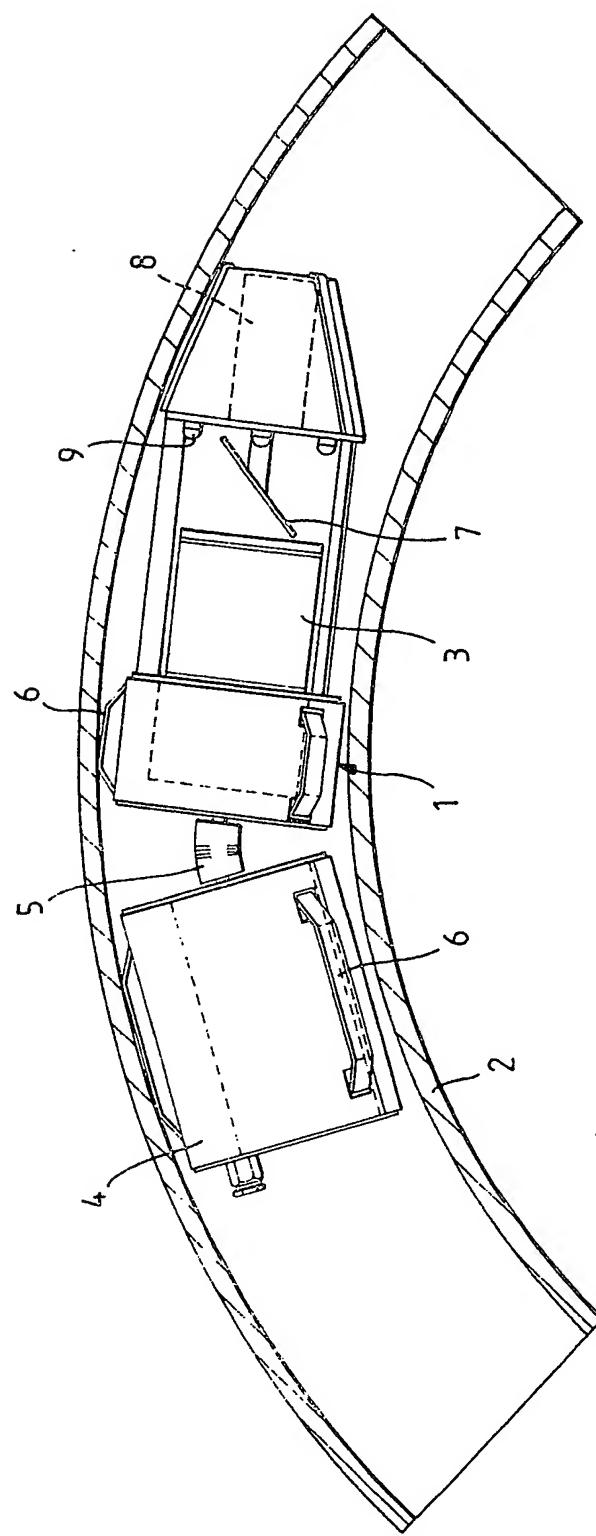


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## SPECIFICATION

## Pipework inspection apparatus

5 The present invention concerns pipework inspection apparatus.  
 It is desirable and often necessary to visually inspect weld roots at the abutting ends of pipe sections from within the bore of 10 the pipe. Such inspections can be carried out on site by straight introsopes and fibre optic introsopes. The former cannot negotiate bends and the latter are both expensive and vulnerable to damage.  
 15 Existing TV camera systems are such that they are unable to negotiate sharp bends in pipes of certain minimum diameter on account of their length. Thus existing TV camera systems cannot negotiate 3D bends in pipework 20 below 100mm diameter (D is diameter of pipework).

To overcome this problem and according to the present invention a TV camera system for the internal inspection of pipework comprises 25 an optical portion and a separate electronics portion, the two portions being connected together by a flexible coupling. As a result the camera system can in effect bend itself around bends in the pipework. Conveniently, 30 the optical portion comprises a rotatable mirror, lens, focus motor and imagining device and the electronics portion comprises the controls, power supplies and video output to recorders and/or monitors. The system can 35 be pushed or pulled along the bore of the pipework.

An embodiment of a camera system for the internal inspection of pipework is illustrated, by way of example, in the accompanying dia- 40 grammatic drawing.

In the drawing, a TV camera system 1 is shown within a pipe 2. The system comprises an optical portion 3 and a control or electronics portion 4, the two portions being con- 45 nected by a flexible coupling 5. As a result of the flexible coupling the system can negotiate bends in the pipe. The two portions are pro- 50 vided with guides 6 which slidably contact the bore of the pipe 2.

55 In order to provide a complete peripheral scan of the pipe bore, and for example to scan the root of a weld between abutting pipe lengths, a mirror 7, inclined preferably at 45° to the longitudinal axis of the optical portion 3, is mounted on the optical portion 3. The 60 mirror 7 is rotatable by a drive motor 8 and lamps 9 are also provided at the leading end of the optical portion. Thus by rotating the mirror it is possible to scan the interior of the pipe through 360°.

It is further desirable to provide means for establishing the angular orientation of the camera system within the pipe upon rotation. This can be achieved by utilising a mercury switch

70 stepping motor that indicates its position relative to the particular orientation and provides a visual display on a control panel. Alternatively, a U-shaped tilt switch can be mounted on the mirror assembly. A vertical picture position is indicated by the tilt-switch being in an open position to illuminate a lamp on the control panel. This operation serves to establish the zero position. Upon rotation of the mirror 75 an optical encoder, integral with the mirror, can provide a pulse for every sixteenth of a rotation of the motor shaft. The motor is coupled to a 2000:1 gearbox and consequently one complete revolution of the motor 80 shaft will generate 32,000 pulses. The pulses are counted and scaled to give a display of position in degrees relative to the vertical.

The above are examples only of possible means for determining camera orientation 85 within the pipe bore.

## CLAIMS

1. Apparatus for the internal inspection of pipework comprising a TV camera system 90 having an optical portion and a physically separate electronics portion, the two portions being connected by a flexible coupling.
2. Apparatus according to claim 1 in which the optical portion includes a rotatable mirror 95 inclined at an angle to the longitudinal axis of the optical portion to perform a complete peripheral scan of a pipe bore.
3. Apparatus according to claim 1 or 2 in- 100 cluding means for establishing the angular orientation of the camera system within the pi- pework.
4. Apparatus for the internal inspection of pipework substantially as herein described with reference to and as illustrated in the ac- 105 companying drawing.

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